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Transmitted by E-mail

To: Joe Haake
Bryan Kury

From: Sungmi Moon, Ph.D.
Atul M. Salhotra, Ph.D.

Date: September 6, 2006

Re: **Our Preliminary Review and Comments on Draft Risk Assessment, Boeing Tract 1 Facility, St. Louis, Missouri Report (EPA Region 7, August 2006)**

As requested, we have completed our preliminary review of the referenced report. This memo discusses our comments on the risk assessments for Subareas 2C, 3F, 3H, and 6B completed by EPA Region 7.

For each subarea, EPA followed the following procedure:

- (i) Estimated the exposure point concentrations (EPCs) using the ProUCL software. Details are provided in Appendix C. These concentrations are summarized in Tables A-3.1 to A-3.9 of Appendix A.
- (ii) Used the EPCs to estimate dose. The calculated values are presented in Tables A-7.1 to A-7.3 of Appendix A.
- (iii) For chemicals that have quantitative toxicity values, risk was estimated and presented in Tables A-7.1 to A-7.3 of Appendix A.

Table 1 lists our comments based on the preliminary review. Also Attachment 1 includes additional comments specific to Appendix C. We identified several discrepancies in the calculation of EPCs, which have been carried forward in the calculation of dose and risk. Therefore, we recommended that EPA revise the calculations based on these comments and resubmit the report for Boeing's review. The large number of discrepancies will likely impact the estimated risk.

At this point we have not reviewed in detail (i) the methodology used by EPA to estimate the risk from TPH, (ii) the basis of the trench model, or (iii) actual calculations. We hope to do this when (i) the above discrepancies have been resolved and (ii) if the results indicate that the primary risk drivers are the TPH methodology and the trench model.

Table 3 compares the results of Boeing's risk assessment and EPA's risk assessment (that needs substantial revisions per comments suggested above). Table 3 indicates the primary drivers (media, constituents, and exposure pathway) for each of the receptors. Such a



table is very helpful to identify risk management options for a site. We suggest this table be revised based on the corrected EPA's risk estimates.

Please call us if you have any questions at 713-784-5151 or contact us by e-mail at skim@ramgp.com and asahotra@ramgp.com.

Table 1
Comments on Draft Risk Assessment for Boeing Tract 1 Facility (August 27, 2006) Prepared by Tetra Tech
Boeing Tract 1 Facility, St. Louis, Missouri

Page	Section/Paragraph/Line	Comment	Changes
8	Section 3.3.2, Line 5	Latest version of reference for J&E Model is EPA, 2004. Reference section should be updated accordingly.	Editorial
10	Table 1, Parameters of GW ingestion rate - non-residential worker and GW ingestion rate - construction worker	This pathway is incomplete pathway. Will be better to put "Incomplete pathway" as in exposure time for dermal contact with GW - non-residential workers on page 9.	Editorial
14	Table 2, Subarea 6B - Industrial Worker	Information of sampling location is not correct and not consistent with calculation of EPC. The latter is correct. Information of sampling location for Subarea 6B - Construction Worker is for Subarea 6B - Industrial Worker.	Editorial
14	Table 2, Subarea 6B - Construction Worker	Information of sampling location is not correct. Should include additional locations of B22E1, B22E2, B22E3, B22N1, B22W1, B27W1, B27W2, B28E1, B28N1, CN1, HW1, MW3, MW7, MW9S, PB1, RC10, RC11, RC12, RC1, RC2, RC3, RC4, RC5, RC6, RC8, RC9, S31B1, S31B2, and S31B3.	Editorial
14	Table 3, Subarea 6B	Groundwater monitoring wells screened in deep zone (B27 W3DW, MW 9DW, RC 6DW, RC 8DW) were included. These wells are screened well below the water table and the concentrations do not contribute to vapor. Suggest reevaluate EPC. Note RA by RAM Group considered only wells screened across the water table.	Impact on risks
15	Table, GRO and DRO	"C9 to C18 Aliphatic" is in GROs and DROs. As per MDEP (October 2002), "C9 to C18 Aliphatic" under GROs should be "C9 to C12 Aliphatic". This should be updated in the tables of the report accordingly.	Editorial
16	Section 3.4, Paragraph 2, Line 8	There is sentence "For duplicate samples, Tetra Tech used the higher value to represent that sampling event." Does this mean that the higher detection limit was used when both original and duplicate samples were not detected?	Clarification
18	Section 3.5.1, Paragraph 1 under "Exposure time, Frequency, and Duration", Line 4	It states "For evaluation of exposure to groundwater in a construction trench, an exposure time of 8 hours per day was assumed." This is not consistent with 4 hrs in Table 1 and Table A-4.2.	Editorial
19	Section 3.5.2, Paragraph 4 under "Exposure Parameters for Inhalation of Volatiles", Sentence 4	There is inconsistency in air exchange rate. It was noticed that Table 6 lists ER of 0.25 l/hr, but J&E Model in Appendix D uses ER of 0.8 l/hr.	Editorial
20	Section 3.5.2, Line 1	Report states that a default Kp of 0.001 is assumed for inorganics. As per EPA (2004), Kps for chromium (VI), nickel, and zinc are 0.002, 0.0006, and 0.0006, respectively.	Impact on risks
21	Table 6, LB	Table 6 states that 12 ft (300 cm) of LB was used. Appendix D shows that 366 cm was used in J&E Model. Note RA by RAM Group used 12 ft.	Editorial
21	Table 6, Capillary fringe thickness	Table 6 states 192 cm of capillary fringe thickness. However, Appendix D shows that 30 cm of capillary fringe thickness was used in J&E Model. Note RA by RAM Group used 192 cm.	Editorial
21	Table 6, Dry bulk density and Soil Particle density	Values for dry bulk density and soil particle density is switched.	Editorial

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Page	Section/Paragraph/Line	Comment	Changes
22	Table 6, ER	Table 6 lists ER of 0.25 1/hr, but J&E Model in Appendix D uses ER of 0.8 1/hr.	Editorial
22	Table 6, H	Table 6 lists H of 0.001 cm ² /cm ² , but J&E Model in Appendix D uses H of 0.000364. Note RA by RAM Group used 0.001.	Editorial
34	Section 5.2.4, Paragraph	Lead in soils was detected in Subarea 2C at the concentration of 8.21 mg/kg. This should be incorporated in the paragraph.	Editorial
43	Last Paragraph, Line 3	"outdoor" should be "indoor".	Editorial
	Figure 3, Page 1	Equations for GW ingestion are not required.	Editorial
	Appendix A, Table A-1, Exposure Point	Soil for construction worker should be 0 - 15 ft bgs not 0 - 10 ft bgs.	Editorial
	Appendix A, Table A-3.4, Value for EPC	Values for EPC for ORO - C19 to C32 Aliphatic and ORO - C19 to C32 Aromatic do not match with values in Appendix C. Should be 540 ug/L not 904 ug/L.	Editorial
	Appendix A, Table A-3.5	Appendix C shows calculation of EPC for methyl ethyl ketone. However, it was not shown in Table A-3.5 and was not used to estimate risk (Table A-7.1).	Impact on risks
	Appendix A, Table A-3.7	As per Appendix C, missing chemicals are barium, chromium, aluminum. EPCs for chromium and aluminum are less than background concentrations; hence they can be eliminated. Barium should be included. EPC values do not match with values in Appendix C for acetone, cis-1,2-dichloroethene, GRO, GRO - C5 to C8 aliphatic, GRO - C9 to C18 aliphatic, and GRO - C9 to C10 aromatic.	Impact on risks
	Appendix A, Table A-3.8	As per Appendix C, missing chemicals are barium, chromium, aluminum. EPCs for chromium and aluminum are less than background concentrations; hence they can be eliminated. Barium should be included. EPC value does not match with value in Appendix C for selenium.	Impact on risks
	Appendix A, Table A-3.9	Missing chemical: Bromomethane Extra chemical: Bromobenzene Discrepancies in EPC values as per Appendix C: 1,1-dichloroethane, 1,1-dichloroethene, 1,2-dichlorobenzene, 1,2-dichloroethene (total), 1,4-dichlorobenzene, acetone, chloroform, MTBE, methylene chloride, tetrachloroethene, toluene, trans-1,2-dichloroethene, vinyl chloride, chromium, lead, selenium, GRO, DRO, GRO - C5 to C8 aliphatic, GRO - C9 to C18 aliphatic, GRO - C9 to C10 aromatic.	Impact on risks
	Appendix A, Table A-4.1, Page 1 of 3, Ingestion/Non-residential indoor worker	EF of 250 day/yr is not consistent with EF of 225 day/yr in Table 1 for non-residential worker. If EF of 225 day/yr is correct, reference should be EPA 2002.	Clarification
	Appendix A, Table A-4.1, Page 2 of 3, Inhalation/Construction Worker	Not clear how PEF was calculated.	Clarification
	Appendix A, Table A-4.1, Page 3 of 3, Inhalation/Non-residential Outdoor Worker	Not clear how PEF was calculated.	Clarification

Table 1
Comments on Draft Risk Assessment for Boeing Tract 1 Facility (August 27, 2006) Prepared by Tetra Tech
Boeing Tract 1 Facility, St. Louis, Missouri

Page	Section/Paragraph/Line	Comment	Changes
	Appendix A, Table A-4.2, Inhalation - Indoors/Non-residential Indoor Worker	EF of 250 day/yr is not consistent with EF of 225 day/yr in Table 1 for non-residential worker. If EF of 225 day/yr is correct, reference should be EPA 2002.	Clarification
	Appendix A, Table A-7.1, First 3 pages, Exposure Point	Soil for construction worker should be 0 - 15 ft bgs not 0 - 10 ft bgs.	Editorial
	Appendix A, Table A-7.1, 7th page, Subarea 3H GW, Dermal	Dose and risk calculations for arsenic, chromium, DRO - C9 to C18 aliphatic, DRO - C9 to C22 aromatic, ORO - C19 to C32 aliphatic, and ORO - C19 to C32 aromatic were not performed.	Impact on risks
	Appendix A, Table A-7.1, 9th page, Subarea 6B GW, Dermal	Dose and risk calculations for chromium were not performed.	Impact on risks
	Appendix A, Table A-7.1, Inhalation of Soil - Construction Worker	Risk calculations were performed for VOCs and PAHs. Risk for metals should be evaluated for inhalation of particulates from soil. PEF value is presented in Table A-4.1.	Impact on risks
	Appendix A, Table A-7.1, Inhalation - Non-residential Outdoor Worker	Risk calculations were performed for VOCs and PAHs. Risk for metals should be evaluated for inhalation of particulates from soil. PEF value is presented in Table A-4.1.	Impact on risks
	Appendix A, Table A-7.1, TPH fractions evaluated in exposure pathways	TPH fractions evaluated in exposure pathways are summarized in the attached Table 2. For dermal contact with soil, GRO - C9 to C10 aromatic, DRO - C9 to C18 aliphatic, DRO - C9 to C22 aromatic, and ORO - C19 to C32 aliphatic were evaluated, but only GRO - C9 to C18 aromatic was evaluated for dermal contact with groundwater. For inhalation pathway, ORO - C19 to C32 aliphatic and ORO - C19 to C32 aromatic were not evaluated for outdoor inhalation from soil and outdoor inhalation from GW, but two additional fractions (GRO - C9 to C18 aliphatic and DRO - C9 to C18 aliphatic) were not evaluated for indoor inhalation from GW.	Impact on risks
	Appendix A	Table A-8 series are missing.	Editorial
	Appendix A, Tables A-9.1 and A-10.1	Soil for construction worker should be 0 - 15 ft bgs not 0 - 10 ft bgs.	Editorial
	Appendix, Tables A-1, A-5.1a, A-5.1b, A-5.2a, A-5.2b, A-6.1, A-6.2, A-7.1, A-7.2, A-7.3, A-9.1, A-9.2, A-9.3, A-10.1, A-10.2, and A-10.3	Please add page numbers for easy reference.	Editorial
B-1	Appendix B, Section B.1, VF under Equation B-1	Equations C-2 through C-5 should be Equations B-2 through B-5.	Editorial
B-1	Appendix B, Section B.1, Last sentence and first sentence of next page	Are these sentence and reference (Tetra Tech, 2006) relevant for Boeing?	Clarification
B-2	Appendix B, Section B.1, KiL under Equation B-3	Equation C-4 should be Equation B-4.	Editorial
B-2	Appendix B, Section B.1, KiG under Equation B-3	Equation C-5 should be Equation B-5.	Editorial
	Appendix B, Table B.1, MW and H	Where were values of MW and H obtained from?	Clarification
	Appendix C	Several discrepancies were identified. Appendix C with markup is attached.	Impact on risks

Table 2
TPH Fraction Evaluated in Exposure Pathways
Boeing Tract 1 Facility, St. Louis, Missouri

Exposure Pathways	TPH Fractions						
	GRO - C5 to C8 Aliphatic	GRO - C9 to C18 Aliphatic	GRO - C9 to C10 Aromatic	DRO - C9 to C18 Aliphatic	DRO - C9 to C22 Aromatic	ORO - C19 to C32 Aliphatic	ORO - C19 to C32 Aromatic
Ingestion of Soil	√	√	√	√	√	√	√
Dermal Contact with Soil	NE	NE	√	√	√	NE	√
Dermal Contact with GW	NE	NE	√	NE	NE	NE	NE
Inhalation of Vapors and Particulates from Soil	√	√	√	√	√	NE	NE
Outdoor Inhalation from GW	√	√	√	√	√	NE	NE
Indoor Inhalation from GW	√ (Hexane)	NE	√ (Naphthalene)	NE	√ (Pyrene)	NE	NE

Notes:

√: TPH fraction evaluated

NE: Not evaluated

*: Shows the surrogate chemical used

Table 3
Summary of Risks by Boeing and EPA
Boeing Tract 1 Facility, St. Louis, Missouri

Area/Receptor	Risk Exceed/Not Exceed				Key Driver for Exceedence in 2006 RA (EPA)		
	Carcinogenic Risk		Non-carcinogenic Risk				
	2004 RA (Boeing)	2006 RA (EPA)	2004 RA (Boeing)	2006 RA (EPA)	Media	Constituent	Pathway
Subarea 2C							
Construction Worker	Not Exceed	Not Exceed	Not Exceed	Exceed	Groundwater	C5 - C8 Aliphatic, C9 - C18 Aliphatic, C9 - C10 Aromatic	Outdoor Inhalation
Outdoor Worker	–	Not Exceed	–	Exceed	Groundwater	C5 - C8 Aliphatic, C9 - C18 Aliphatic	Outdoor Inhalation
Indoor Worker	–	Not Exceed	–	Exceed	Groundwater	C5 - C8 Aliphatic	Indoor Inhalation
Non-residential Worker	Not Exceed	–	Not Exceed	–			
Subarea 3F							
Future Construction Worker	NA	NA	Not Exceed	Not Exceed			
Future Outdoor Site Worker	–	NA	–	Not Exceed			
Future Indoor Site Worker	–	NA	–	Not Exceed			
Future Non-residential Worker	NA	–	Not Exceed	–			
Subarea 3H							
Future Construction Worker	Not Exceed	Not Exceed	Not Exceed	Exceed	Groundwater	C9 - C18 Aliphatic, C9 - C22 Aromatic	Outdoor Inhalation
Future Outdoor Site Worker	–	Not Exceed	–	Not Exceed			
Future Indoor Site Worker	–	Not Exceed	–	Not Exceed			
Future Non-residential Worker	NA	–	Not Exceed	–			
Subarea 6B							
Construction Worker	Not Exceed	Exceed	Not Exceed	Exceed	Groundwater	TCE, Several COCs	Dermal Contact, Outdoor Inhalation
Outdoor Site Worker	–	Not Exceed	–	Exceed	Groundwater	C9 - C18 Aliphatic	Outdoor Inhalation
Indoor Site Worker	–	Exceed	–	Exceed	Groundwater	Dichlorofluoromethane, C5 - C8 Aliphatic	Indoor Inhalation
Future Non-residential Worker	Not Exceed	–	Exceed	–			

Notes:

—: Not receptor of concern

NA: Not applicable - no constituents identified

Exceed: Risk exceeds acceptable level and hence will require risk management.

APPENDIX C

**SUMMARY STATISTICS OF GROUNDWATER AND SOIL EXPOSURE POINT
CONCENTRATIONS**

(10 Pages)

**Summary Statistics for Subarea 2C
Soils Construction Worker**

Chemical	Detections/Samples	Minimum Detected (ug/kg)	Maximum Detected (ug/kg)	Exposure Point Concentration (ug/kg)	Rationale
TPH					
GRO	6 8/8	13000	25000	13000	Approximate gamma distribution
DRO	3 11/10	38000	133000	145616	99% Chebyshev (mean, sd)
ORO	2/8		34000	47000	95% Chebyshev (mean, sd)
GRO - C5 to C8 Aliphatic				43340.53	48,840.53 Prorated from GRO
GRO - C9 to C18 Aliphatic				"	48,840.53 Prorated from GRO
GRO - C9 to C10 Aromatic				"	48,840.53 Prorated from GRO
DRO - C9 to C18 Aliphatic				128083.7	662,197.50 Prorated from DRO
DRO - C9 to C22 Aromatic				"	662,197.50 Prorated from DRO
ORO - C19 to C32 Aliphatic				19816.3	17,884.46 Prorated from ORO
ORO - C19 to C32 Aromatic				"	17,884.46 Prorated from ORO
VOCs					
Benzene	4 11/11	57	1.25	307	156.3 Approximate gamma
Ethylbenzene	3 11/11	227	1.25	408	408 maximum
Toluene	5 11/11	52	2.5	3000	2,599 99% Chebyshev (MVUE) UCL
Xylene	5 11/11	257	2.5	829	800.808 Adjusted gamma
Methylene chloride	1/1		5.8	5.8	5.8 maximum
Lead	1/1	8210	8210	8210	Maximum

**Summary Statistics for Subarea 2C
Groundwater**

Chemical	Detections/Samples	Minimum Detected (ug/L)	Maximum Detected (ug/L)	Exposure Point Concentration (ug/L)	Rationale
TPH					
GRO	8/8	500	301200	201,957.40	95% Chebyshev (mean, sd)
DRO	2/11	180	1000	612.47	Students t-test
ORO	n/a			—	
GRO - C5 to C8 Aliphatic				67,319.13	Prorated from GRO
GRO - C9 to C18 Aliphatic				67,319.13	Prorated from GRO
GRO - C9 to C10 Aromatic				67,319.13	Prorated from GRO
DRO - C9 to C18 Aliphatic				306.23	Prorated from DRO
DRO - C9 to C22 Aromatic				306.23	Prorated from DRO
VOCs					
Benzene	12/12	0.25	981	508.5	95% Chebyshev (mean, sd)
Ethylbenzene	12/12	0.25	180	165.8	99% Chebyshev (mean, sd)
MTBE	2/10	9.9	59	59	maximum
Toluene	12/12	2.5	59.6	34.7	95% Chebyshev (mean, sd)
Xylene	12/12	0.75	23.6	15.9	95% Chebyshev (mean, sd)

Subarea 2C Groundwater

**Summary Statistics for Subarea 3F
Soils for Construction Worker**

Chemical	Detections/Samples	Minimum Detected (ug/kg)	Maximum Detected (ug/kg)	Exposure Point Concentration ug/kg	Rationale
Metals					
Lead	2/2	6190	8780	8,780 maximum	

3F Soils Construct

**Summary Statistics for Subarea 3F
Groundwater**

Chemical	Detections/Samples	Minimum Detected (ug/L)	Maximum Detected (ug/L)	Exposure Point Concentration (ug/L)	Rationale
TPH					
TPH - DRO	1/1	514	514	514 maximum	
TPH - ORO	2 1/1 2	463 1080	1080	1,080 maximum	
DRO - C9 to C18 Aliphatic					257 Prorated from DRO
DRO - C9 to C22 Aromatic					257 Prorated from DRO
ORO - C19 to C32 Aliphatic					540 Prorated from ORO
ORO - C19 to C32 Aromatic					540 Prorated from ORO

**Summary Statistics for Subarea 3H Soils
Construction Worker**

Chemical	Detections/Samples	Minimum Detected (ug/kg)	Maximum Detected (ug/kg)	Exposure Point Concentration (ug/kg)	Rationale
TPH					
TPH - DRO	3 2123	6260-47000	55000	55,000 maximum	
DRO - C9 to C18 Aliphatic				27,500 Prorated from DRO	
DRO - C9 to C22 Aromatic				27,500 Prorated from DRO	
VOCs					
Methyl ethyl ketone	1/1	8.8	8.8	8.8 maximum	
Xylene	1/3	9.4	9.4	9.4 maximum	
Not included in Table A-3.5					
Metals					
Lead	1/1	8630	8630	8630 maximum	
Acetone	1/1	21	21	21 maximum	
Methylene chloride	1/1	4.5	4.5	4.5 maximum	

**Summary Statistics for Subarea 3H
Groundwater**

Chemical	Detections/Samples	Minimum Detected (ug/L)	Maximum Detected (ug/L)	Exposure Point Concentration (ug/L)	Rationale
TPH					
TPH - DRO	3 2/2 3	648	3500		3540 maximum
TPH - ORO	1/1		520		520 maximum
DRO - C9 to C18 Aliphatic					1,770 Prorated from DRO
DRO - C9 to C22 Aromatic					1,770 Prorated from DRO
ORO - C19 to C32 Aliphatic					260 Prorated from ORO
ORO - C19 to C32 Aromatic					260 Prorated from ORO
VOCs					
1,2-Dichlorobenzene	2/3	3	3.7		3.7 maximum
Carbon disulfide	1/2	2.1	2.1		2.1 maximum
Methylene chloride	1/3	5.3	5.3		5.3 maximum
Toluene	1/4	2.2	2.2		2.2 maximum
Metals					
Arsenic	1/1	80	80		80 maximum
Barium	1/1	1910	1910	1910	490 maximum
Chromium	1/1	14	14		14 maximum
Copper	1/1	17	17		17 maximum
Lead	1/2	68	68		68 maximum
Mercury	1/1	0.5	0.5		0.5 maximum
Nickel	1/1	23	23		23 maximum
Zinc	1/1	378	378		378 maximum

3H Groundwater

**Summary Statistics for Subarea 6B Soils
Industrial Worker**

Chemical	Detections/Samples	Minimum Detected (ug/kg)	Maximum Detected (ug/kg)	Exposure Point Concentration (ug/kg)	Rationale
VOCs					
1,2-Dichloroethene (total)	1/8	36	36	36 maximum	
Acetone	1/1	14	14	14 maximum	
Ethylbenzene	1/10	2000	2000	2,000 maximum	
Tetrachloroethene	3/6	0.29	15	10.7 Student's t-test	
Toluene	2/10	51	83000	83,000 maximum	
Trichloroethene	1/1	0.062	0.062	0.062 maximum	
PAH					
Fluoranthene	1/5	520	520	520 maximum	
Pyrene	1/5	500	500	500 maximum	
Metals					
Arsenic	11/11	8950 8800	40100	30,743.9 Student's t-test	
Barium	11/11	53100	306000	187,120.6 Student's t-test	
Cadmium	3/11	550	2520	1,669.6 95% Chebyshev (mean, sd)	
Chromium	11/11	13700	22700	19,090.6 Student's t-test	
Lead	11/11	12800	32700	25,658.1 Student's t-test	
Mercury	10 11/11	21.7 2	60	41.9 Student's t-test	
Selenium	3/11	3570	3660	4,152.5 95% Chebyshev (mean, sd)	
Aluminum	10/10	3930000	12700000	10,635,212.0 Student's t-test	
Antimony	10/10	2040	5510	4,966.0 Student's t-test	
Beryllium	10/10	451	1340	1,085.8 Student's t-test	
Cobalt	10/10	5200	15100	10,976.5 Approximate gamma	
Copper	10/10	13300	28100	22,744.3 Student's t-test	
Manganese	10/10	141000	4310000	2,294,135.0 Approximate gamma	
Nickel	10/10	12600	62300	37,601.8 Student's t-test	
Vanadium	10/10	20000	47700	41,457.5 Student's t-test	
Zinc	10/10	38900	67500	58,376.0 Student's t-test	

Not included
in Table A-3.8

BG from RA by RAM

9,200

58,000

4,000,000

**Summary Statistics for Subarea 6B Soils
Construction Worker**

Chemical	Detections/Samples	Minimum Detected (ug/kg)	Maximum Detected (ug/kg)	Exposure Point Concentration (ug/kg)	Rationale
TPH					
TPH - GRO	5/14	220	16000	12,610	99% Chebyshev (mean, sd)
TPH - DRO	1/18/44	980000	980000	980,000	maximum
GRO - C5 to C8 Aliphatic				4,203.43	Prorated from GRO
GRO - C9 to C18 Aliphatic				4203.33 3,927.67	Prorated from GRO
GRO - C9 to C10 Aromatic				4203.33 3,927.67	Prorated from GRO
DRO - C9 to C18 Aliphatic				490,000.00	Prorated from DRO
DRO - C9 to C22 Aromatic				490,000.00	Prorated from DRO
VOCs					
1,2-Dichloroethene (total)	5/21	36	250	190.4	99% Chebyshev (mean, sd)
Acetone	15/38/32/30	14	200	89.44	99% Chebyshev (mean, sd)
cis-1,2-Dichloroethene	3/28/19	9.1	1800	988.02	99% Chebyshev (mean, sd)
Ethylbenzene	3/38/26	11	2000	1449.47	99% Chebyshev (mean, sd)
Methylene chloride	10/28/27	5	31	11.22	95% Chebyshev (mean, sd)
Tetrachloroethene	9/38/37	0.28	43	11.11	95% Chebyshev (mean, sd)
Toluene	4/38/26	16	83000	24,093.66	99% Chebyshev (mean, sd)
Trichloroethene	9/28/27	0.062	390	166.11	99% Chebyshev (mean, sd)
Vinyl chloride	5/28/27	4.7	600	231.4	99% Chebyshev (mean, sd)
PAHs					
Chrysene	4/14/15	30	210	148.4	97.5% Chebyshev (mean, sd)
Metals					
Arsenic	32/37/14/26	1100	130000	30,743.0	Student's t-test
Barium	26/37/14/26	53100	306000	187,120.6	Student's t-test
Cadmium	9/37/14/26	140	2520	1,669.6	95% Chebyshev (mean, sd)
Chromium	26/37/14/26	11000	31000	19,090.6	Student's t-test
Lead	26/37/14/26	6000	32700	25,668.0	Student's t-test
Mercury	22/14/26	15	60	41.9	Student's t-test
Selenium	5/14/26	660	5650	4,106.4	95% Chebyshev (mean, sd)
Aluminum	10/10	3930000	12700000	10,635,212.0	Student's t-test
Antimony	10/10	2040	7940	4,966.0	Student's t-test
Beryllium	10/10	451	1340	1,085.8	Student's t-test
Cobalt	10/10	5200	15100	10,976.5	Approximate gamma
Copper	10/10	13300	28100	22,744.3	Student's t-test
Manganese	10/10	141000	4310000	2,294,135.0	Approximate gamma
Nickel	10/10	12600	62300	37,601.8	Student's t-test
Vanadium	10/10	20000	47700	41,457.5	Student's t-test
Zinc	10/10	38900	67500	58,375.0	Student's t-test

Not included
in Table A-39

Missing Chemicals

6B Soil Construction

1,1-Dichloroethane
1,1-Dichloroethene
Methyl ethyl ketone
trans-1,2-Dichloroethene

Xylenes
Avalon 1254
Acenaphthene
Acenaphthylene

Benzo(a)anthracene
Benzo(b)fluoranthene
Fluoranthene
Fluorene

phenanthrene
pyrene

Same as EPC for industrial worker (?)

**Summary Statistics for Subarea 6B
Groundwater**

Chemical	Detections/Samples	Minimum Detected (ug/L)	Maximum Detected (ug/L)	Exposure Point Concentration (ug/L)	Rationale
TPH					
GRO	10/18 15	130	3600 7000	5,737.60	99% Chebyshev (mean, sd)
DRO	6/18 18	150 2900	340000	199,255.90	99% Chebyshev (mean, sd)
ORO	2 1/2	210-420	420	420	maximum
GRO - C5 to C8 Aliphatic				1912.53	Prorated from GRO
GRO - C9 to C18 Aliphatic				1912.53	Prorated from GRO
GRO - C9 to C10 Aromatic				1912.53	Prorated from GRO
DRO - C9 to C18 Aliphatic				99,612.95	Prorated from DRO
DRO - C9 to C22 Aromatic				99,612.95	Prorated from DRO
ORO - C19 to C32 Aliphatic				210.00	Prorated from ORO
ORO - C19 to C32 Aromatic				210.00	Prorated from ORO
VOCs					
1,1-Dichloroethane	22/144	1.0 1.4	17	11.02	97.5% Chebyshev (mean, sd)
1,1-Dichloroethene	17 18/144	0.34	26	11.59	97.5% Chebyshev (mean, sd)
1,2,3-Trimethylbenzene	1/14 13	3.1	3.1	3.1	maximum
1,2,4-Trimethylbenzene	3/113	1.7	2.7	2.7	maximum
1,2-Dichlorobenzene	9/113	90	200	35.08	97.5% Chebyshev (mean, sd)
1,2-Dichloroethene (total)	10/21	0.49	6200	4,012.66	Hall's Bootstrap
1,2-Dichloropropane	1/157 144	1.9	1.9	1.9	maximum
1,3-Dichlorobenzene	3/113	1.2	3.2	3.2	maximum
1,4-Dichlorobenzene	8/113	10	23	9.64	97.5% Chebyshev (mean, sd)
Acetone	11/144	7.1	74	74	maximum
Benzene	6/144	0.85	150	17.09	97.5% Chebyshev (mean, sd)
Bromodichloromethane	1/157 144	1.8	1.8	1.8	maximum
Bromomethane	1/157 144	23	23	23	maximum
Carbon disulfide	3/12 39	0.4 0.37	0.51	0.51	maximum
Chloroethane	1/157 144	1.2	1.2	1.2	maximum
Chloroform	6/146 144	5.4	11	11	maximum
cis-1,2-Dichloroethene	78/131	1.1	7600	1,851.95	99% Chebyshev (mean, sd)
Dichlorodifluoromethane	2/144 113	2.6	700	700	maximum

Not included
in Table A-3.9

**Summary Statistics for Subarea 6B
Groundwater**

Ethylbenzene	3/144	0.77	4.2	4.2 maximum
Isopropylbenzene	2/124 113	3.4	4.5	4.5 maximum
Methyl ethyl ketone	1/157	87	87	87 maximum
MTBE	7/113	2.3	930	63.08 97.5% Chebyshev (mean, sd)
Methylene chloride	10, 9/144	0.38	520	43.79 97.5% Chebyshev (mean, sd)
n-Propyl benzene	2/124 113	1.8	2.4	2.4 maximum
sec-Butylbenzene	1 2/124 113	1.4	1.4	1.4 maximum
tert-Butylbenzene	1/124 113	1.5	1.5	1.5 maximum
Tetrachloroethene	14/144	5.7	260	23.22 97.5% Chebyshev (mean, sd)
Toluene	10/144	0.37	41	30.62 97.5% Chebyshev (mean, sd)
trans-1,2-Dichloroethene	63, 69/137 121	1.1	410	105.7 99% Chebyshev (mean, sd)
Trichloroethene	60, 66/150 144	0.92 1.1	8000	1,165.18 99% Chebyshev (mean, sd)
Trichlorofluoromethane	6, 8/116 114	2.5 1	10	10 maximum
Vinyl chloride	6 7, 37/150 144	1.2	2700	660.6 99% Chebyshev (mean, sd)
Xylene, total	3/144	2.2	12	12 maximum
Metals				
Barium	67 73, 75 67	310	57000	8,623 97.5% Chebyshev (mean, sd)
Cadmium	16/68 67	2	42	42 maximum
Chromium	52, 54/188 70	2.2	2560	616.03 H-UCL
Lead	52, 55/136 7	5.2	1180	212.88 H-UCL
Mercury	28, 30/73 67	0.07 0.056	130	13.3 97.5% Chebyshev (mean, sd)
Selenium	4/38 36	5	36.4	36.4 99.17 maximum

Missing Chemicals

1,1,2-Trichloro-1,2,2~
 Arsenic
 Silver
 Acenaphthene
 Aroclor 1254
 Benzo (a) anthracene
 Chrysene
 6B Groundwater